WATER QUALITY
M E M O R A N D U M

Utah Coal Regulatory Program

August 26, 2005

TO: Internal File

THRU: D. Wayne Hedberg, Permit Supervisor

FROM: Dana Dean, P.E., Senior Reclamation Hydrologist

RE: 2004 Third Quarter Water Monitoring, Nevada Electric Investment Company, Wellington Preparation Plant, C/007/0012-WQ04-03, Task #2164

1. Was data submitted for all of the MRP required sites? YES ☒ NO ☐
Identify sites not monitored and reason why, if known:

2. On what date does the MRP require a five-year resampling of baseline water data.
See Technical Directive 004 for baseline resampling requirements. Consider the five-year baseline resubmittal when responding to question one above. Indicate if the MRP does not have such a requirement.

Resampling due date December 10, 2009

3. Were all required parameters reported for each site? YES ☒ NO ☐
Comments, including identity of monitoring site:

4. Were irregularities found in the data? YES ☒ NO ☐
Comments, including identity of monitoring site:

Several parameters fell outside of two standard deviations from the mean encountered at the respective sites. They were:

Site	Parameter	Value	Standard	Mean

			Deviations from Mean	
GW-1	Depth	15.33 ft	3.02	10.6 ft
GW-1	Water Level	5367.27	2.39	5372 ft
GW-1	Dissolved Magnesium	234 mg/L	4.27	261 mg/L
GW-1	Total Hardness	2070 mg/L	2.06	2168 mg/L
GW-9B	Dissolved Calcium	505 mg/L	2.92	387 mg/L
GW-12	Dissolved Calcium	478 mg/L	2.90	326 mg/L
GW-12	Dissolved Iron	27.6 mg/L	2.01	8.64 mg/L
GW-12	Sulfate	9753 mg/L	2.02	4031 mg/L
GW-15A	Depth	11.63 ft	2.21	7.37 ft
GW-15A	Dissolved Calcium	432 mg/L	3.09	394 mg/L
GW-15A	Dissolved Potassium	5.85 mg/L	2.06	4.78 mg/L
GW-15B	Depth	11.54 ft	2.64	6.69 mg/L
GW-16	Dissolved Calcium	361 mg/L	3.92	308 mg/L
GW-16	Dissolved Sodium	396 mg/L	2.13	430 mg/L
GW-16	Total Hardness	1906 mg/L	2.43	1760 mg/L
GW-17	Specific Conductivity	1200 umhos/cm	2.27	2440 umhos/cm
GW-17	Laboratory pH	7.06	2.25	7.77
GW-17	Dissolved Calcium	97.9 mg/L	4.09	52.51 mg/L
GW-17	Dissolved Magnesium	29.7 mg/L	2.49	61.22 mg/L
GW-17	Dissolved Sodium	122 mg/L	3.66	458 mg/L
GW-17	Lab Sp. Conductivity	1128 umhos/cm	3.64	2482 umhos/cm
GW-17	Total Dissolved Solids	754 mg/L	3.33	1622 mg/L

The depth/water level readings show that the water table in the permit area is decreasing (by a maximum of 8 feet - at GW-15b). However, this is most likely not attributable to the Wellington Preparation plant, since they have no underground operations and do not pump any water from below ground. The water levels also seem to follow the Palmer Hydrologic Drought Index and the Surface Water Supply Index, at least until May of 2003. This suggests that the groundwater in the area receives recharge through surface water, and that the current drought situation has caused the well levels to drop.

The dissolved magnesium at GW-1 and GW-17 has been steadily dropping since monitoring began at those sites ($R^2 = 0.70$, 0.72 respectively). There is a strong correlation to water level at GW-1 ($R^2 = 0.61$), so the overall drop in water levels may be the reason for the drop in magnesium at that site. There are no criteria for this metal, but it contributes to water hardness, which also has an overall downward trend at these sites. A drop in magnesium and hardness levels is a positive change in water quality.

The total hardness at GW-16 has a general upward trend. The samples for May and August 2004 are the highest ever recorded at the site, but since all recorded values of hardness at this site are greater than 1600 mg/l, and therefore in the very hard range (>300 mg/l), the increased values do not represent a degradation of water quality.

The dissolved calcium levels have fluctuated at each of the listed sites, but have an overall upward trend. There is not a strong correlation to water level for any of the sites. There are no criteria for this metal, but it does contribute to water hardness. The hardness at each of these sites has always fallen into the hard (150-300 mg/l) to very hard (>300 mg/l) classifications, with most samples over 1000 mg/l (all samples at GW-17B and 16 of 69 samples at GW-12 were below 1000 mg/l). It is not clear why the calcium level has been increasing, but this does not represent a degradation of water quality.

The dissolved iron at GW-12 has fluctuated widely with a sharp increasing trend since September of 1998. The highest dissolved iron recorded before that was 6 mg/l (3-3-1993), and only 3 of the 24 samples were above 1 mg/l. Since that time, the value has risen from 0.3 mg/l to 27.8 mg/l at the peak, with 11 of 23 samples greater than 10 mg/l and 9 greater than 20 mg/l. At the same time, there were 5 of 23 samples less than 1 mg/l, and 7 less than 5 mg/l. The dissolved iron does not correlate at all to level, and has only had such a dramatic rise at this well. The secondary water quality standard for iron (based on taste and appearance only) is 0.3 mg/l, and for industrial use, the limit is 0.2 mg/l. The aquatic life standard (warm water fisheries) is 1.0 mg/l. Since the groundwater at the Wellington Preparation Plant does not support aquatic life, and has usually been above 0.2 mg/l, the rise in dissolved iron does not represent a degradation of water quality. However, it will be important to watch the trend, and if it continues to rise dramatically, find the cause.

The sulfate at GW-12 has fluctuated, but has a definite upward trend ($R^2 = 0.74$). There is no correlation to well level. The pH at GW-12 has remained in an acceptable range (6.8-8.86), except for a reading of 4.65 in March of 1992. Sulfate is not toxic to plants or animals (even at very high concentration), but has a laxative effect on humans in concentrations over 500 mg/L. For this reason, the EPA has set the secondary standard as 250 mg/L. The sulfate at GW-12 has almost always been greater than 250 mg/L, but the Division will continue to closely monitor the trend of this parameter.

The dissolved potassium at GW-15A has a slight upward trend ($R^2 = 0.3194$). The level seems to go down as the well-elevation rises. There is no water quality standard for potassium and the 5.85 mg/l is still a relatively low number.

The dissolved sodium at GW-16 has a slight downward trend and at GW-17, it has declined sharply since the second quarter of 2002. The sodium content does not correlate to water elevation at either site. There is no water quality standard for sodium, but it does increase the salinity of water. High salinity in irrigation water can decrease yields, depending on the crop. For example, using formulae from the University of Nebraska Cooperative Extension, the yield for a tall fescue would vary from 75-96% for the salinity range at GW-16, and GW-17. The reduction in sodium is a positive trend.

The specific conductivity (measured in the field and lab) and total dissolved solids (TDS) at GW-17 have been steadily declining since sampling began. Specific conductivity is closely related to TDS. There is not a correlation to well depth, and even the lowest reading (800 mg/L)

is well above the EPA's secondary standard of 500 mg/L for drinking water. As the TDS decreases, the quality of the water improves.

Several routine Reliability Checks were outside of standard values. They were:

Site	**Reliability Check**	**Value Should Be…**	**Value is…**
SW-1	TDS/Conductivity	>0.55 & <0.75	0.78
SW-1	Conductivity/Cations	> 90 & < 110	84
SW-1	Mg/(Ca + Mg)	< 40 %	47%
SW-1	Ca/ (Ca + SO4)	> 50 %	31%
SW-2	TDS/Conductivity	>0.55 & <0.75	0.83
SW-2	Conductivity/Cations	> 90 & < 110	78
SW-2	Mg/(Ca + Mg)	< 40 %	49%
SW-2	Ca/ (Ca + SO4)	> 50 %	30%
GW-1	Cation/Anion Balance	< 5%	5.6%
GW-1	TDS/Conductivity	>0.55 & <0.75	1.06
GW-1	Conductivity/Cations	> 90 & < 110	66
GW-1	Mg/(Ca + Mg)	< 40 %	47%
GW-1	Ca/ (Ca + SO4)	> 50 %	26%
GW-4	Cation/Anion Balance	< 5%	5.3%
GW-4	TDS/Conductivity	>0.55 & <0.75	1.07
GW-4	Conductivity/Cations	> 90 & < 110	67
GW-4	Mg/(Ca + Mg)	< 40 %	51%
GW-4	Ca/ (Ca + SO4)	> 50 %	25%
GW-6	TDS/Conductivity	>0.55 & <0.75	1.03
GW-6	Conductivity/Cations	> 90 & < 110	69
GW-6	Mg/(Ca + Mg)	< 40 %	57%
GW-6	Ca/ (Ca + SO4)	> 50 %	24%
Site	**Reliability Check**	**Value Should Be…**	**Value is…**
GW-7	TDS/Conductivity	>0.55 & <0.75	0.82
GW-7	Conductivity/Cations	> 90 & < 110	80
GW-7	Mg/(Ca + Mg)	< 40 %	59%
GW-7	Ca/ (Ca + SO4)	> 50 %	19%
GW-8	Cation/Anion Balance	< 5%	6.3%
GW-8	TDS/Conductivity	>0.55 & <0.75	1.18
GW-8	Conductivity/Cations	> 90 & < 110	58
GW-8	Mg/(Ca + Mg)	< 40 %	75%
GW-8	Ca/ (Ca + SO4)	> 50 %	12%
GW-9	Cation/Anion Balance	< 5%	7.1%
GW-9	TDS/Conductivity	>0.55 & <0.75	1.40
GW-9	Conductivity/Cations	> 90 & < 110	51
GW-9	Mg/(Ca + Mg)	< 40 %	76%
GW-9	Ca/ (Ca + SO4)	> 50 %	10%

GW-9B	Cation/Anion Balance	< 5%	5.9%
GW-9B	TDS/Conductivity	>0.55 & <0.75	1.40
GW-9B	Conductivity/Cations	> 90 & < 110	55
GW-9B	Mg/(Ca + Mg)	< 40 %	69%
GW-9B	Ca/ (Ca + SO4)	> 50 %	15%
GW-10	Cation/Anion Balance	< 5%	6.9%
GW-10	TDS/Conductivity	>0.55 & <0.75	1.46
GW-10	Conductivity/Cations	> 90 & < 110	49
GW-10	Mg/(Ca + Mg)	< 40 %	69%
GW-10	Ca/ (Ca + SO4)	> 50 %	14%
GW-12	Cation/Anion Balance	< 5%	5.3%
GW-12	TDS/Conductivity	>0.55 & <0.75	1.49
GW-12	Conductivity/Cations	> 90 & < 110	49
GW-12	Mg/(Ca + Mg)	< 40 %	78%
GW-12	Ca/ (Ca + SO4)	> 50 %	11%
GW-14	Cation/Anion Balance	< 5%	5.5%
GW-14	TDS/Conductivity	>0.55 & <0.75	1.13
GW-14	Conductivity/Cations	> 90 & < 110	56
GW-14	Mg/(Ca + Mg)	< 40 %	69%
GW-14	Ca/ (Ca + SO4)	> 50 %	15%
GW-15A	TDS/Conductivity	>0.55 & <0.75	0.98
GW-15A	Conductivity/Cations	> 90 & < 110	68
GW-15A	Mg/(Ca + Mg)	< 40 %	40%
GW-15A	Ca/ (Ca + SO4)	> 50 %	34%
GW-15B	TDS/Conductivity	>0.55 & <0.75	0.92
Site	**Reliability Check**	**Value Should Be…**	**Value is…**
GW-15B	Conductivity/Cations	> 90 & < 110	74
GW-15B	Ca/ (Ca + SO4)	> 50 %	36%
GW-16	TDS/Conductivity	>0.55 & <0.75	1.20
GW-16	Conductivity/Cations	> 90 & < 110	58
GW-16	Mg/(Ca + Mg)	< 40 %	53%
GW-16	Ca/ (Ca + SO4)	> 50 %	27%
GW-17	Cation/Anion Balance	< 5%	9.5%
GW-17	Ca/ (Ca + SO4)	> 50 %	44%

The Permittee should work with the lab to make sure that samples pass all quality checks so that the reliability of the samples does not come into question. These inconsistencies do not necessarily mean that a sample is wrong, but it does indicate that something is unusual. An analysis and explanation of the inconsistencies by the Permittee would help to increase the Division's confidence in the samples. The Permittee can learn more about these reliability checks and some of the geological and other factors that could influence them by reading Chapter 4 of *Water Quality Data: Analysis and Interpretation* by Arthur W. Hounslow.

5. **Were DMR forms submitted for all required sites?**

1st month,	YES ☒	NO ☐
2nd month,	YES ☒	NO ☐
3rd month,	YES ☒	NO ☐

All DMRs reported "no flow".

6. Were all required DMR parameters reported? YES ☒ NO ☐

Comments, including identity of monitoring site:

All DMRs reported "no flow".

7. Were irregularities found in the DMR data? YES ☐ NO ☒

Comments, including identity of monitoring site:

All DMRs reported "no flow".

8. Based on your review, what further actions, if any, do you recommend?

No further actions are required at this time.

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